

## MINOR NOTICES

**Lodgepole burn forests.**—The Forest Service has recently issued a bulletin which should be of great interest to all ecologists. Dr. F. E. CLEMENTS,<sup>3</sup> working as collaborator, has made a study of the forests of lodgepole pine in the vicinity of Long's Peak, Colorado. He finds that the lodgepole forests in that region are invariably related to forest fires, since the tree reproduces abundantly only under the conditions initiated by such events.

By a determination of the ages of the oldest plants, principally lodgepoles, which have come into the given locality since the fire, and by study of fire scars upon the trunks, he sets the date of the fire and determines the extent of country affected by it. In this way he has discovered the dates and determined the extents of many fires of the past two centuries, with considerable accuracy in the case of the recent ones, with less accuracy in the case of the less recent. Eight fires were found to have affected the region during the nineteenth century, and the areas covered by several of them overlap. There were four fires during the eighteenth century and a probable one in 1676. The accuracy with which the dates may be determined is due to the fact that abundant reproduction of lodgepole occurs the first year after the fire, and the majority of the trees are therefore even-aged to the year.

A study of the life history of the species follows, in which is found the explanation of the particular type of forest which the lodgepole pine produces. Immediate and abundant reproduction is favored by fire because (1) it causes the opening of many cones at once without damaging the seed; (2) it brings about the temporary disappearance of rodents, which ordinarily consume immense quantities of seed; (3) abundant light is provided, a necessity for reproduction and growth in this species; (4) cover competition is destroyed.

Finally, the future development and treatment of lodgepole forests are discussed. If fire is kept out, the lodgepole forest zone will be gradually narrowed and ultimately crowded out of existence by encroachment of Douglas fir from below and of Engelmann spruce and subalpine fir from above, owing to the much greater tolerance of shade which these species possess. In order to produce a new crop of lodgepole, clear cutting of the forest will be necessary, followed by thorough burning. Mere cutting without fire does not produce the requisite conditions.—WILLIAM S. COOPER.

## NOTES FOR STUDENTS

**Alcoholic fermentation.**—Important contributions to our knowledge of the fermentation of sugar have been made by HARDEN and YOUNG, and by IWANOFF, in their experiments on the action of phosphates in alcoholic fermentation. Although these investigators agree in the main, their views differ as to the details of the reactions involved in the fermentation of sugar in the presence

<sup>3</sup> CLEMENTS, F. E., The life history of lodgepole burn forests. U.S. Dept. Agri., Forest Service Bulletin 79. pp. 56. pls. 6. fig. 1. 1909.